Transport modelling and inversions for the interpretation of greenhouse gas measurements

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Abstract

The interpretation of greenhouse gas measurements can be aided by forward transport modelling while greenhouse gas fluxes can be estimated using atmospheric inversions. Here we (a) provide an update on a study of methane model simulations at Cape Grim and their use for determining methane fluxes from SE Australia and (b) show results from some recent CO_2 inversions.

Observed and model simulated non-baseline methane concentrations at Cape Grim have been compared [Loh *et al.*, 2014]. Two atmospheric models (CCAM and ACCESS) and six different methane emission scenarios are used. To minimise the influence of transport model errors on the analysis, deviations of Cape Grim methane concentration above baseline have been compared to coincident radon measurements. This methane to radon ratio shows a clear seasonal signal implying seasonal variations in methane emissions from SE Australia relative to a more temporally uniform radon flux. The ability of the model simulations to match the observed seasonality is dependent on the choice of methane emission scenario but all scenarios underestimate the observed methane to radon ratio in spring. We find that the most likely explanation for the discrepancy is wetland emissions that are too small in some emission scenarios or at the wrong time of year in other scenarios.

CO_2 inversions have been run recently for two purposes. The first is an international comparison of greenhouse gas inversions focussed on South, East and South East Asia. We have submitted a CCAM inversion for 1993-2012 using a fixed year of winds and expect to submit a second inversion with interannually varying winds. The second purpose is to use a CO_2 inversion to estimate the magnitude of regional fluxes that are required to fit the larger difference in annual mean CO_2 concentration between Mauna Loa and Cape Grim over recent years.

References

Loh, Z. M., R. M. Law, K. D Haynes, P. B. Krummel, L. P. Steele, P. J. Fraser, S. Chambers and A. Williams, Simulations of atmospheric methane for Cape Grim, Tasmania, to constrain South East Australian methane emissions, *Atmos. Chem. Phys. Discuss.*, *14*, 21189-21221, 2014.